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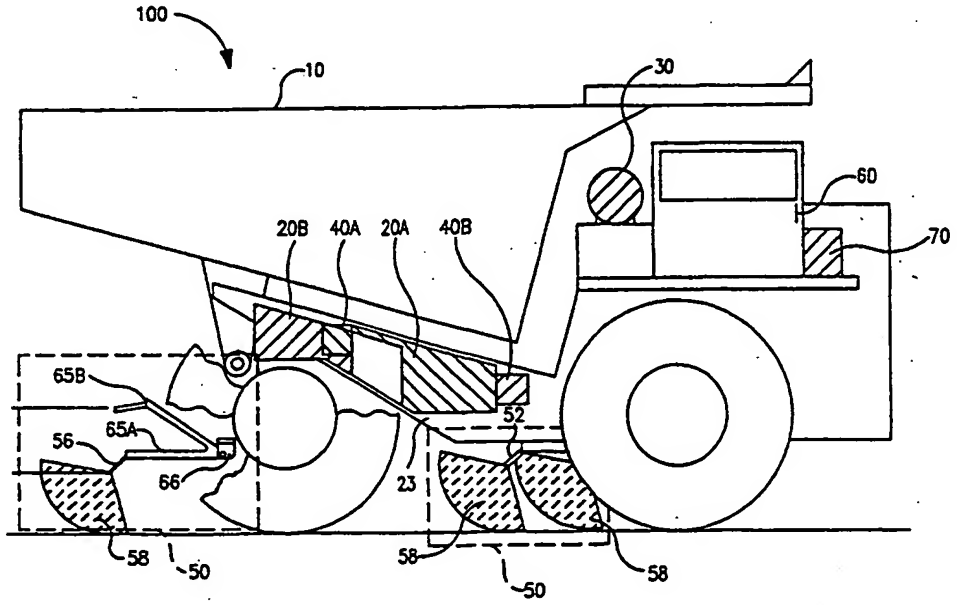

(57) Abstract

A dust suppression system (100) for use with vehicles (10) is disclosed. The system includes a fluid supply (20) and at least one sprayer (58) positioned proximate a dust generation device of the vehicle (10). A control system (80) is suitably configured to monitor movement of the vehicle and activate the sprayer when a predetermined movement of the vehicle (10) is detected.

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ELECTROSTATIC WATER SPRAY DUST SUPPRESSION SYSTEM FOR MOBILE DUST SOURCES

TECHNICAL FIELD

The present invention relates, generally, to dust suppression systems, and more particularly the use of electrostatically charged water particles sprayed on dust particles generated by moving vehicles.

BACKGROUND OF THE INVENTION

Stricter federal regulation of air quality, increased health consciousness, and increased community concern have together caused greater scrutiny of fugitive dust which can be generated by trucks, trailers and the like moving over a dust laden area such as may be occasioned in open pit mining, heavy construction, farming and/or military operations. By controlling fugitive dust, benefits result not only from regulatory compliance, increased air quality, improved worker health conditions, and improved community relations, but also from increased productivity of vehicles that can travel faster because the driver's vision is clearer.

Mining and construction operations currently control fugitive dust that is generated by mobile equipment sources, such as heavy truck, earth moving equipment, and similar vehicles, by using chemical stabilization products or water sprays from tank trucks. For example, chemical stabilization products can be sprayed onto mining or construction road surfaces, or blade mixed into the soil at weekly or monthly intervals. Using chemical stabilization products is disadvantageous and costly because, for example, it often requires repeat application after rainfalls which wash the product away, and the chemical constituents may interfere with mineral processing reagents during certain mining operations. As will be discussed in greater detail hereinbelow, a preferred application of the present invention is in mining and

construction fields; however, it should be appreciated that the subject invention is not limited to those applications. More fundamentally, use of chemical stabilization products does not control dust efficiently, particularly over the long term, without repeated applications.

Water sprays for controlling fugitive dust are typically performed by water trucks that have been adapted with large volume tanks and a spray distribution system attached to the front or rear of a truck's body. These water trucks travel the mining or construction haul roads spraying water at regular time intervals. While water truck spraying is easy to apply and fairly readily available, it also is disadvantageous because the dust control only lasts short durations and the use of extra water in an effort to increase dust control tends to cause slippery conditions which may interfere with production trucks and the like. Moreover, the practice can be costly due to the necessity to purchase, maintain and operate a water truck, and the practice causes increased truck travel on roadways.

Due to the disadvantages associated with using either chemical stabilization or water tank trucks for controlling dust control from moving sources, there exists a need for a dust suppression system or apparatus that is highly efficient in controlling fugitive dust generated by mobile equipment and easy to administer.

It is known that liquids such as water can be atomized by spray nozzles or similar atomizing devices, and the atomized liquids can be inductively charged by passing a spray of atomized liquid particles through a ring which is maintained at some potential relative to the atomizing apparatus. It is also known that particles of fugitive dust carry a small electrical charge. See, for example, Hoenig, Russ, and Bidwell, "Application of Electrostatic Fog Techniques To The Control of Respiratory Particulates," published by the Department of Electrical Engineering, University of Arizona, dated April 16, 1976, and revised May 1, 1976. When electrostatically charged water particles are sprayed on fugitive dust particles which have an opposite charge, the water and dust are attracted by opposite charges, causing the dust particles to agglomerate and fall to the earth under gravitational forces.

While vehicles which may be equipped with devices for depositing coatings on surfaces such as roads are known, see for example, U.S. Patent No. 3,807,634 issued April 30, 1974 to Vogt, such systems tend to be complex and cumbersome. While it is also known to apply such systems to motor vehicles, see for example, U.S. Patent No. 1,499,760 issued July 1, 1924 to Bandelier, these systems are also cumbersome and do not efficiently prevent the generation or long term suppression of fugitive dust, such as may be experienced in mining and/or construction operations. In typical devices which may be used to dispense an atomized spray of an electrostatically charged liquid to remove dust or similar fine pollutant particles from an atmosphere, a metal ring electrode is typically positioned in a coaxial relationship around the tip of a spray nozzle. Alternatively, the spray may also be generated from around an electrode tip. When the liquid, such as water, is discharged from the device, the atomized water particles are given a small electrostatic charge of the same polarity as the charge of the electrode device which is typically opposite to the polarity of the dust particles in suspension. These devices tend to be unsafe, particularly because they present shock hazards for humans. As a result, and as is set forth, for example, in U.S. Patent No. 4,335,419 issued June 15, 1982 to Hastings, such devices tend not to be used. Moreover, the device as is set forth in the '419 patent to Hastings, tends to be cumbersome and complex. While other sprayers, such as paint sprayers and the like, tend to be less cumbersome, their use in dust control systems is not known.

SUMMARY OF THE INVENTION

The present invention addresses these disadvantages of prior methods for controlling dust from moving sources by providing a system for spraying electrostatically charged water droplets onto dust particles generated by the moving source. The system is suitably mounted on the moving dust source, *e.g.* a mine haulage truck, and enables water to be pumped through atomizing spray nozzles which atomize the water into droplets and add an electrostatic charge to droplets as

they are discharged onto an area of fugitive dust behind a moving vehicle. The electrostatically charged water droplets become attracted to dust, causing the dust particles to agglomerate and fall out of the atmosphere due to gravitational forces, thus less water tends to be required to enable suppression of the dust, such as, for example, may be used with conventional water tank trucks.

In accordance with a preferred exemplary embodiment of the present invention, the system comprises a water tank, a water pump, and a plurality of electrostatically charged water spray nozzles, all connected by an appropriately placed network of pipes, hoses, and valves and mounted on a production vehicle, such as a mine haulage truck. Also mounted on the vehicle is a power transformer or, alternatively, an electrical generator. The transformer converts conventional truck battery or generator power into a power source that is connected via a wiring network to the spray nozzles and provides the power for the water pump and for the electrostatic charge that is imparted to the atomized water droplets. If an independent electrical generator is used, it produces electrical power which is provided to the water pump and the electrostatic charge.

Preferably, the system also includes an air compressor and an air pump both of which are connected to the spray nozzles, thus enabling enhancement of the atomization and spraying process. A control panel is optimally connected to the water pump, air compressor, and spray nozzle control valve to provide for both manual and automatic activation of the spraying system. The control panel is also connected to the speed measuring mechanism of the production vehicle upon which the system is mounted and uses the vehicle's speed to automatically activate and/or increase or decrease the rate of water dispersion as a function of the speed of the vehicle.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

Preferred and alternative exemplary embodiments of the present invention will be hereinafter described in conjunction with the appended drawing figures, wherein like designations denote like elements, and:

Figure 1 is a schematic side view of a preferred exemplary embodiment of a dust suppression system in accordance with the present invention as installed upon a vehicle, such as a haulage truck;

Figure 2 is a top view of a preferred truck and spray system design, in this view with the bed of the haulage truck removed;

Figure 3 is a schematic back view of a preferred truck device also with the truck bed removed;

Figure 4 is a schematic lay out of a preferred embodiment of an operator monitor and control panel useful in connection with a dust suppression system in accordance with the present invention;

Figure 5 is a system schematic of a control system useful in connection with a preferred dust suppression system, such as that shown in Figures 1-4; and,

Figure 6 is a side view of a preferred spray gun useful in connection with the dust suppression system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EXEMPLARY EMBODIMENTS

As previously alluded to in the Background section of this application, the subject matter of the present invention is particularly suited for use in connection with mining, construction, farming and/or military operations. In that regard, a preferred exemplary embodiment of the present invention will be described in the context of a haulage truck of the type commonly used in connection with mining operations. It should be recognized that this description is not intended as a limitation on the use or applicability of the subject invention but rather serves to

merely describe a preferred embodiment thereof. As a result, in connection with this description, the term "vehicle" will be used to describe the illustrated haulage truck. It should be appreciated, however, that the subject matter of the present invention is suitable for broad application to a variety of mobile vehicles which may be used in environments creating dust or other particulate contaminants to be created as a result of the vehicles movement. For example, applications in the agricultural, construction, tractor trailer and military context are also contemplated as being within the subject matter of the present invention. Specifically, as used herein, the term "vehicle", should be understood to refer to the various vehicles which can be used in these environments, such as loaders, dozers, graders, scrapers, excavators, tanks, people movers, plows, harvesting machinery (*e.g.* bailers, fertilizing equipment, spreaders, combines, etc.), long wall mining equipment, haulage trucks, tractor trailers, street sweepers and the like.

While the details and operation of a preferred exemplary embodiment of the present invention in the context of a haulage truck (*e.g.* "vehicle") will be described hereinbelow, it should be appreciated that the present invention addresses the various disadvantages of the prior art and other known devices by, in general, providing a simple and efficient dust suppression system which preferably is suitably oriented and configured to be activated and/or controlled based in part upon the movement of the vehicle to which it is attached. In this regard, while dust refers to particulate dust or other matter, it should be appreciated that control of any particulate matter may be accomplished through use of the present invention. This simple system enables the efficient and reliable activation, deactivation and dispensation of electrostatically charged fluid to the region of interest at rates and levels which are suitably controlled to both minimize usage of the charged fluid and maximize effectiveness of the system itself.

Referring now to Figure 1, in accordance with a preferred exemplary embodiment of the present invention, a vehicle 10 is suitably provided with a dust suppression system 100 including a fluid supply 20, an affiliated compression system

30, a power source 40, a spray system 50, an operator interface panel 60 and a generator 70. Preferably, system 100 also relies on and uses a movement detector 75, for example, a movement detector which is integral with vehicle 10. In accordance with a preferred aspect of the present invention, detector 75 comprises the speedometer of vehicle 10 and/or a motion (*e.g.* forward vs. reverse) detector. Optional additional elements, as described herein, may also be utilized.

With reference to Figures 1-3, preferably fluid supply 20 comprises one or more water tanks suitably mounted to the chassis of vehicle 10. In accordance with a preferred exemplary embodiment of the present invention, supply system 20 suitably comprises fluid tanks 20A, 20B, and 20C (20C is seen on Figure 2) which are suitably custom designed to be mounted on the chassis of vehicle 10. In accordance with the exemplary embodiment, tank 20A is a 700 gallon capacity tank, and 20B and 20C are each 50 gallon capacity tanks. However, the size and shape of tanks 20A, B, C can be adapted to fit the vehicle upon which it is to be mounted and to meet the volume and pressure demands of the system user.

Preferably, the fluid contained within tanks 20A, 20B, and 20C comprises water or another suitable fluid which may be easily charged so as to carry an appropriate electrostatic charge sufficient to suppress the dust generated through movement of vehicle 10. As will be recognized by those skilled in the art, fluids other than water may be employed, however, due to relatively low cost, availability, and simplicity of use, water is preferred. In addition, it should be appreciated that chemical additives such as soaps or other like components also may be utilized to increase the dust suppression efficiencies of the fluid. For example, one may employ deliquescent salts, lignosulfonates, bitumens and the like, as desired. In addition, binding agents, soaps, etc. may be used to improve moisture content, reduce freezing or clogging of the fluid, or otherwise improve fluid efficiency.

Referring now to Figure 2, a water pump 22 is suitably connected via appropriate plumbing (*e.g.* pipes) to water tanks 20A, 20B, and 20C. In the illustrated embodiment, pump 22 comprises a high pressure turbine pump of

conventional design, and is preferably mounted integrally with water tank 20A such as to a chassis 23 of vehicle 10. However, those skilled in the art will recognize that pumps of varying size, capacity, and pressure could also be employed and selected according to the desired specifications of a particular application and the vehicle upon which it is to be mounted.

With continued reference to Figure 2, a spray system 50 suitably includes electrostatic spray guns 51-57 which may be mounted to chassis 23 of vehicle 10 in locations that optimally direct a spray 58 toward positions where dust is likely to be produced by vehicle 10. In particular, in accordance with the preferred exemplary embodiment, spray guns 51-56 are optimally mounted so that spray 58 is directed behind each of the vehicles tires. Spray gun 57 is similarly mounted to chassis 23, but preferably is located to direct spray 58 behind the engine compartment of vehicle 10 to suppress dust generated by the radiator fan (not shown). In the event vehicle 10 comprises a vehicle which is movable through use of devices, for example tracks or the like, as opposed to tires, it should be appreciated that spray guns are optimally mounted in relation to such devices.

Spray guns 51-57 receive fluid via appropriately routed plumbing (*e.g.* pipes) from pump 22. In accordance with a preferred aspect of the present invention, guns 51-57 are each designed to permit variability of the spray rate. Commercially available guns, such as Binks Model 80 or 77C, may be used and may be fitted with spray nozzles such as Binks Model N 66 fluid nozzles and air nozzles such as Binks Model N 63 PX air nozzles. Although the type, model, and size of the electrostatic spray guns are not critical to the present invention, it is important that the spray guns be electrostatic and provide an electrostatic charge to atomized water or other fluid particles that are discharged through the spray nozzles. It should be appreciated, however, that the specific size and specifications of the spray guns and nozzles utilized in accordance with the present invention may be selected as needed to fit a specific dust suppression application.

Guns 51-57 preferably comprise, in general, devices which enable sufficiently wide spray patterns at flow rates in the range of 0.5 to 3 liters per minute per gun. Typically, use of guns 51-57 advantageously produce fluid particle sizes in the range of between about 50 and about 200 microns, more preferably between about 70 to about 110 microns. With reference to Figure 6, gun 51 (as well as each of guns 52-57) preferably comprises a base 91, a body 92, respective adapters 93A-E, a nozzle 94 and a tip 95. Preferably, adapters 93A-E communicate with suitable hoses or wiring which are connected to water tanks 20, to compressor 30 and/or to power supplies 40A-C. As such, pressurized fluid is suitably communicated to gun 51. Typically, fluid (water) is provided at a rate of about 0 to about 2.0 GPM, and more preferably at about 1.2 GPM. Moreover, the fluid is typically pressurized at a rate of between about 30 to about 40 psi, and more preferably at about 35 psi. The voltage applied to spray guns 51-57 is on the order of about 0 to about 150 KV, and preferably about 75 KV. Preferably nozzle 94 provides a large orifice diameter, for example on the order of about 0.75 inch, through which tip 95 extends. As will be appreciated, fluid directed past tip 95 will be suitably electronically charged. Preferably such charge is in the range of about 0 to about 150 KV, more preferably about 75 to about 100 KV at the gun exit. Dissipation will, of course, lower that charge as the fluid is caused to agglomerate with the dust particles.

As will be described in greater detail hereinbelow, the system preferably is utilized to activate and/or deactivate guns 51-57 as a function of vehicle speed. Alternatively, guns 51-57 may further be configured such that the spray rate is suitably adjusted as a function of, for example, vehicle speed; *i.e.* as vehicle 10 increases speed, the spray rate is also suitably increased.

Spray guns 51-57 operate using a combination of fluid (*e.g.* water), compressed air, and electrical power. In accordance with a further preferred aspect of the present invention, fluid is pumped through spray guns 51-57 and through nozzles 94 (shown on Figure 6) and onto the selected areas where dust is generated. Compressed fluid and air are suitably supplied to spray guns 51-57 to enhance the

efficacy of the spray patterns and distribution. Preferably, air compressor 30 suitably compresses the fluid (*e.g.* water) which, in turn, is supplied to guns 51-57. In addition, air compressor 30 preferably includes an air pump (not shown) such that air is also supplied to guns 51-57 to suitably atomize the compressed fluid. Compressor 30 may be mounted in any convenient manner, for example, as is shown in the illustrated embodiment, behind the cab of vehicle 10. In accordance with a preferred aspect of the present invention, compressor 30 comprises, for example, a two-stage Dayton Model 4364K36 compressor rated at a flow of 24.4 cfm at 175 psi. Appropriate plumbing channels the compressed fluid and air from compressor 30 to spray guns 51-57. For example, a nonconductive hose, such as McMaster Carr Model 54765K64, may be used for this purpose.

Alternatively, guns 51-57 can be suitably configured to receive compressed fluid from a pneumatic system that is part of the vehicle's own hydraulic system, should such a pneumatic system be available on the vehicle or easily added to the vehicle. As will be appreciated, the demands and specifications of a dust suppression operation will dictate whether the vehicle's internal pneumatic system can adequately satisfy the system needs.

Spray guns 51-57 suitably receive electrical power from one or more power supplies 40A, 40B, and 40C (see Figures 1-3). These power supplies provide the electrostatic charge that is transferred to fluid droplets passing through spray nozzles 94 of guns 51-57. In the preferred exemplary embodiment, three separate power supplies, namely 40A, 40B, 40C are used. In accordance with a preferred aspect of the present invention, supply 40B may suitably comprise a Binks model 111-3005 (which is designed to provide electrostatic power to three Binks spray guns) and supplies 40A and 40C suitably comprise Binks model 111-3000 (which are designed to provide electrostatic power to two Binks spray guns). However, as will be appreciated, any number, brand, or model of commercially available power supplies may be used in the context of the present invention provided that the polarity is adjusted opposite to that of the dust requiring suppression.

Compressor 30, as will be appreciated, can be suitably powered, such as through the vehicle power source, or from an electrical power generator 70. In the event generator 70 is utilized, it may be suitably mounted on vehicle 10, for example, on the front operators' deck of vehicle 10. Generator 70 suitably comprises any commercially available generator, such as Dayton model 4W113. In an alternative embodiment, the battery and generator that are part of vehicle 10's internal combustion engine system could be used in combination with a power transformer to produce electrical power. In such alternative embodiment, the power transformer can supply electrical power to air compressor 30 as well as other electrical components of the dust suppression system discussed herein.

Generator 70 may be of any conventional design, and as such, be gas or diesel fueled. (The fuel supply associated with generator 70 is preferably integral therewith, or as discussed hereinbelow, may be from the fuel system of vehicle 10.) Preferably, generator 70 comprises a gasoline fueled generator, such as Dayton Model 4W113, rated at about 7500 watts, suitably positioned, for example, in or on vehicle 10. In accordance with a particularly preferred aspect of this embodiment, generator 70 is suitably located in the vicinity of the operator's cab of vehicle 10. Generator 70 is suitably connected to operator interface panel 60 to enable convenient automatic start-up.

For convenience and to assist refueling economics, it may be preferable that generator 70 comprise a diesel fueled generator (Dayton Model 4W115). In such case, and with reference to Figure 5, an inverter 69, such as a Newark Tripplite 04F873 24 VDC to 120 VAC emitter, may be used to enable generation of suitable electrical power from diesel generator 70 to support water pump 22 and compressor 30. With reference to Figure 2, inverter 69 is preferably mounted on the upper deck of vehicle 10, for example, in the vicinity of generator 70. Preferably, inverter 69 is contained in a weather proof electrical enclosure of conventional design.

Generator 70 also provides electrical power via appropriate wiring to operator interface panel 60 (seen in Figures 1, 2 and 4), various sensors (not shown) located

on or near spray guns 51-57, and water pump 22. The electrically powered sensors suitably provide status information to indicator lights on operator interface panel 60. For example, by viewing operator interface panel 60, as seen more specifically in Figure 4, the driver of vehicle 10 can determine whether the various elements of the dust suppression system have power and, as applicable, adequate air pressure, water pressure and electrical drive. Operator interface panel 60 suitably comprises an 8"x12" by 1/8" thick aluminum panel with indicator lights, labeling, and wiring of conventional design.

As shown in Figure 4, various parameters of truck 10 are suitably displayed to the operator, such as respective indicator lights 12A, B, C, D, E, F, G, reflective of air and water being "on" or "off" for each of guns 51-57. Respective on/off lights 14A, B, C for each of power supplies 40A-C are also provided, as are respective lights 16A, B, C, D, E, F indicative of the state of compressor 30, filter units, controller 80, inverter 69, generator 60 and generator fuel supply. Optimally, indicators 17A, B, C, which are reflective of the state of water pump 22, the water supply and water filter, may also be provided, as may be an indicator 18A, which is indicative of the position of manifold 65. A toggle switch 19 may be used to manually effect movement of manifold 65 by switching it from the "raise" position to the "lower" position or vice versa. Finally, a system power button 11 may be employed to manually activate or deactivate the system.

As will be appreciated, these displayed parameters, as well as others, as desired, are suitably monitored, detected and/or controlled by controller 80. Referring now to Figure 5, controller 80 advantageously comprises a microprocessor based control unit suitably connected to receive input data reflective of at least the speed and direction of vehicle 10. Controller 80 sends signals to and receives signals from power supplies 40A, 40B, and 40C, operator interface panel 60, compressor 30, and spray guns 51-57. By appropriate commands programmed into controller 80 by conventional means, controller 80 activates and/or deactivates the spray flow through spray guns 51-57. The spray flow through the spray guns may be increased or

decreased as a function of, for example the speed of vehicle 10. Preferably, the system is configured such that guns 51-57 are activated and/or deactivated as vehicle 10 attains a predetermined speed. Controller 80 is suitably connected to a truck control or vehicle interface 62 providing signals of truck speed and direction, such that, for example, when vehicle 10 begins a reverse direction, controller 80 turns off power supplies 40A, 40B and 40C as well as spray guns 51-57.

In accordance with one aspect of the present invention, the present system is configured such that guns 51-57 are activated when a signal reflective of a movement of vehicle 10, by a speed of about 2 mph is sent to controller 80. At such time, guns 51-57 are activated as by controller 80 to discharge electrostatically charged fluid at a rate of about 0.4 litres/minute. As signals reflective of an increase in the speed of vehicle 10 are sent to controller 80, such as up to about 25 mph, guns 51-57 can be activated by controller 80 to discharge electrostatically charged fluid at a proportional rate of up to about 4.5 litres/minute. Alternatively, controller 80 can be suitably programmed to cause guns 51-57 to be activated and provide a substantially constant discharge of electrostatically charged fluid, for example preferably at a rate of between about 0.1 and about 10, more preferably about 0.4 to about 7.5 and optimally about 4.5 to about 5.0 liters per minute over moderate to low vehicle speeds.

It will be obvious to those skilled in the art that controller 80 could be programmed to adjust the spray in a variety of different combinations and based on inputs other than those described in this exemplary embodiment. For example, by varying the rate of spray intermittently, or over predetermined patterns or in any other desirable fashion.

In addition to controlling spray guns 51-57, controller 80 monitors the state of the electronic sensors described above and provides status information to operator interface panel 60. For example, in the illustrated embodiment of vehicle 10, it is desirable that the spray guns located at the rear of the vehicle be moved out of the way during truck dumping operations. In such cases, for example, and with reference

to Figure 1, manifold 65 is suitably moved from an operating position 65A to a stowed position 65B, as shown, as dumping operations begin. Manifold 65 may be suitably driven by a motor 66 suitably mounted on or near the frame of vehicle 10. Upon receipt of a suitable signal, for example, indicative of the bed of vehicle 10 being raised to commence dumping activities, manifold 65 may be raised to stowed position 65B.

In accordance with a preferred exemplary embodiment of the invention, when manifold 65 is in operating position 65A, spray guns 53-56 are suitably positioned at a height above the ground of between about 2 and 5 feet, and more preferably at about 3 feet. Suitably, spray guns 51-52 and 57 are similarly positioned.

In order to minimize maintenance, the plumbing from pump 22 to spray guns 51-57, and the pneumatic lines from air compressor 30 to spray guns 51-57 may be equipped with disposable/replaceable cartridge filters. These filters are not shown on the figures as their placement can be at any convenient location suitable for vehicle 10, such as in the form of in-line units installed within the pumping network.

In operation, vehicle 10 will perform its usual function in mining operations, such as by being loaded with mined material. However, before vehicle 10 is loaded, tanks 20 are preferably filled. Then, as the driver hauls vehicle 10's load, controller 80 will turn on spray guns 51-57 at a designated speed, for example, in the range of about 2 to about 25 mph. Such action causes electrostatically charged water droplets to be sprayed directly onto the dust that is generated as vehicle 10 travels along its path, for example a mining road.

It should be appreciated that in accordance with other preferred embodiments, controller 80 can be configured to increase the flow of spray through spray guns 51-57 as the speed of vehicle 10 increases. In accordance with such embodiment, as the speed of vehicle 10 increases, the quantity of water output increases, offsetting the increased production of dust.

It will be understood that the foregoing description is of preferred exemplary embodiments of the invention, and that the invention is not limited to the specific

forms shown herein. Various modifications may be made in the design and arrangement of the elements set forth herein without departing from the scope of the invention as expressed in the appended claims. For example, as previously mentioned, the present invention may be employed in connection with farm machinery (such as combines, balers, harvesting equipment, etc.), military vehicles (such as tanks, people movers, etc.), construction equipment (such as dozers, graders, scrapers, etc.), and even on such vehicles as street sweepers. Application of the present invention to street sweepers would provide dust suppression in a context where a greater number of humans may be exposed to the dust generated. Application in the military setting may provide the particular benefit of making vehicles moving through a desert setting less obvious from a distance. These other modifications in the design, arrangement and application of the present invention as now known or hereafter devised by those skilled in the art are contemplated by the appended claims.

CLAIMS

We claim:

1. A dust control system comprising:

a vehicle including at least one dust generation device;

a fluid supply attached to said vehicle;

a spray system including means for electrostatically charging the fluid in said fluid supply, said system including at least one sprayer proximate said at least one dust generation device, said sprayer including means to discharge said electrostatically charged fluid;

a movement detector integral with said vehicle and configured to monitor vehicle movement;

a control system configured to interact with said movement detector such that as the movement and/or speed of said vehicle reaches a predetermined value, said spray system is activated.

2. The dust control system of claim 1 wherein said at least one dust generation device comprises a wheel.

3. The dust control system of claim 1 further comprising a compressor system attached to said vehicle, said compressor system being operationally connected to said fluid supply and to said spray system.

4. The dust control system of claim 3 wherein said compressor system includes a compressor to compress said fluid and an air source.

5. The dust control system of claim 4 wherein said air source communicates air to said sprayer to atomize said electrostatically charged fluid.

6. The dust control system of claim 5 wherein said sprayer comprises a spray gun.

7. The dust control system of claim 1 wherein said movement detector comprises a speedometer.

8. The dust control system of claim 7 wherein said movement detector further comprises a detector to detect the forward or rearward direction of said vehicle.

9. The dust control system of claim 1 further comprising a power source attached to said vehicle, said power source arranged to communicate power to said spray system.

10. The dust control system of claim 3 further comprising a power generator attached to said vehicle, said power generator arranged to communicate power to said compressor system.

11. The dust control system of claim 1 further comprising an operator interface panel positioned on said vehicle.

12. The dust control system of claim 11 further comprising a manifold positioned on said vehicle, said manifold configured to carry said at least one sprayer.

13. The dust control system of claim 12 wherein said manifold is movable from a first position to a second position and said dust control system further comprises means for effecting movement of said manifold from said first position to said second position.

14. The dust control system of claim 13 further comprising an activation device on said operator interface panel, said activation device being operably connected to said manifold movement means.

15. A dust control system comprising for mining applications:

a mine haulage truck, said truck having a plurality of tires, and a speedometer;

at least one fluid supply tank attached to said truck, said tank being filled with water;

a spray system including at least one sprayer positioned proximate at least one of said plurality of tires and means for electrostatically charging said water, said sprayer being capable of discharging said charged water;

a control system configured to receive a signal from said speedometer, said control system including means for activating said at least one sprayer to discharge said electrostatically charged water when said signal from said speedometer is reflective of predetermined movement of said truck.

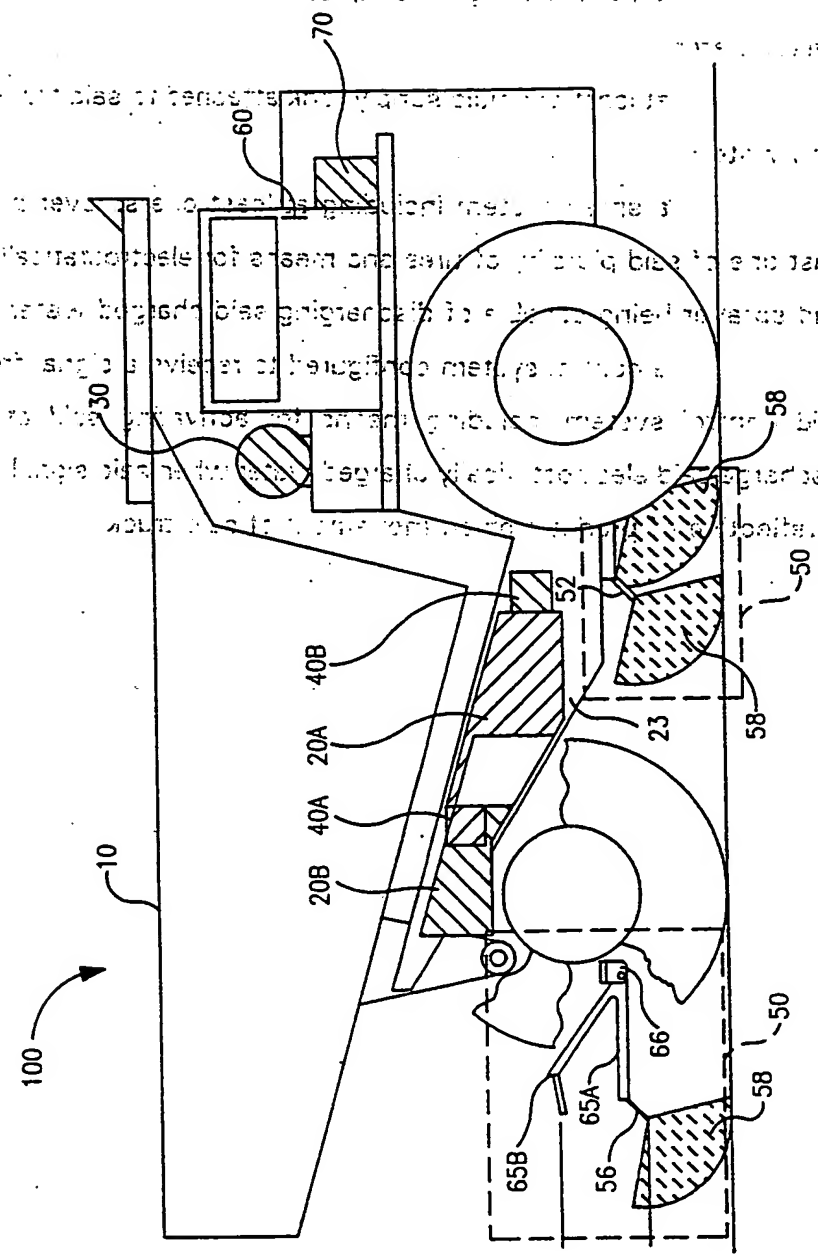

FIG. 1

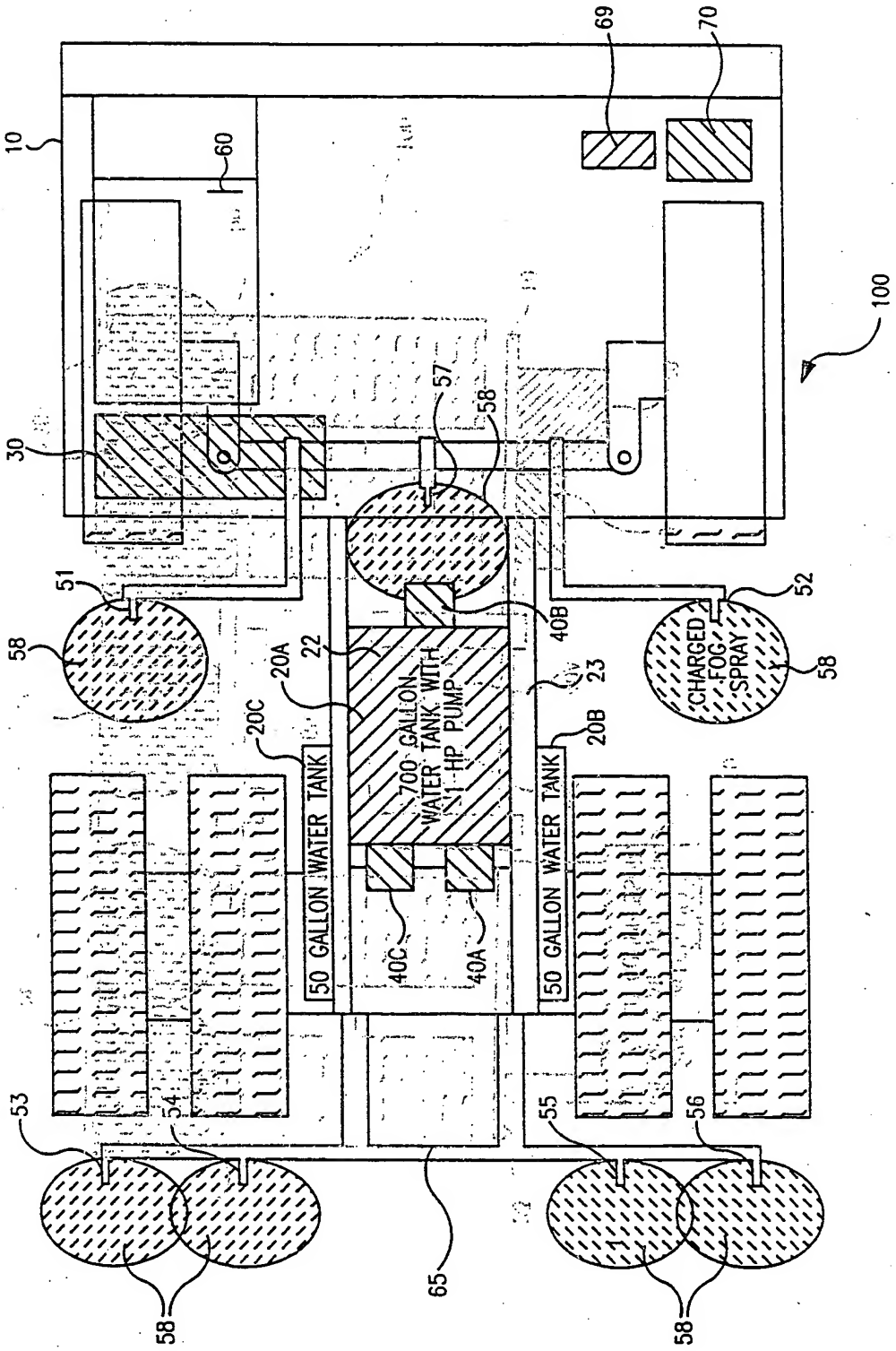

FIG. 2

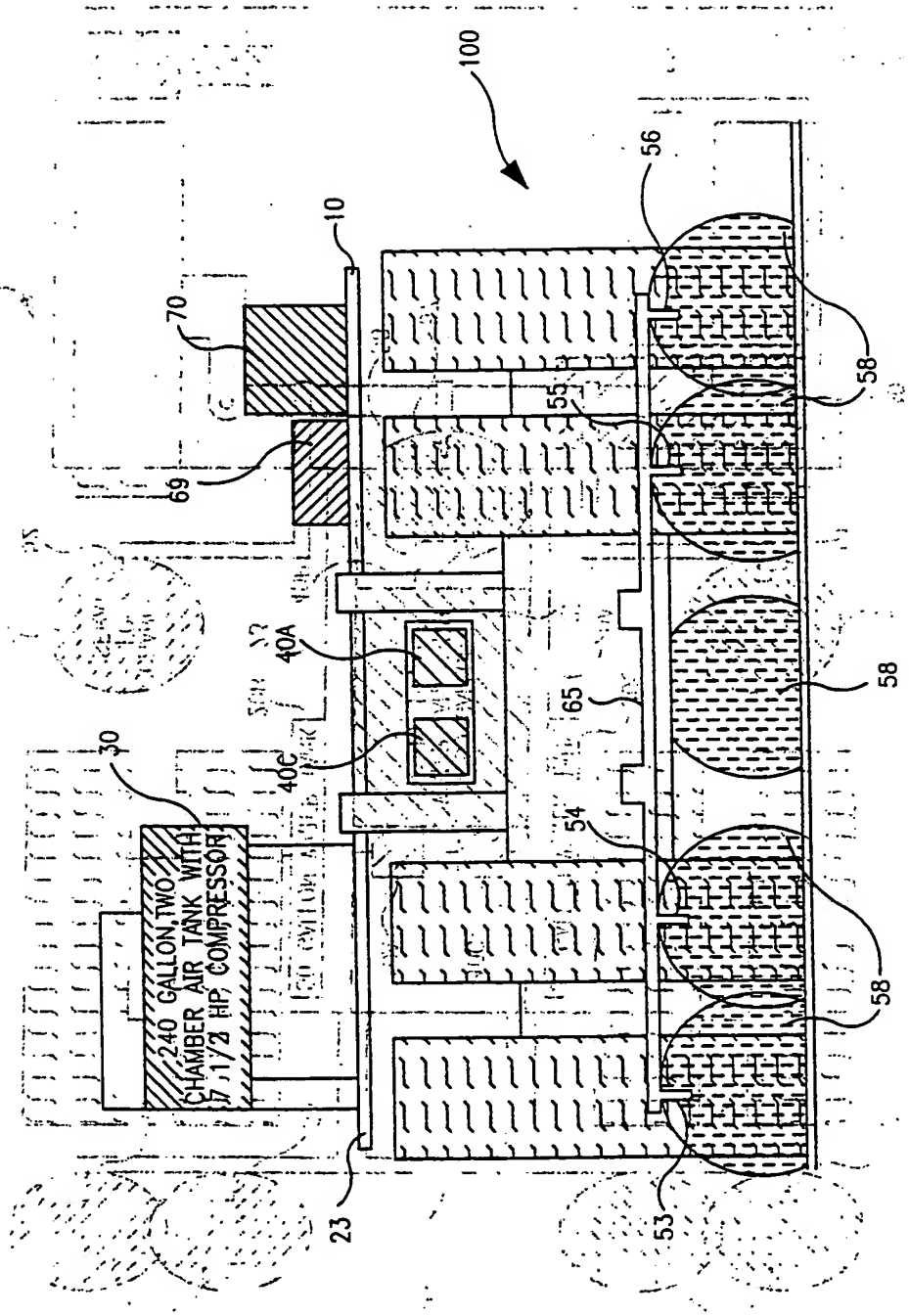

FIG. 3

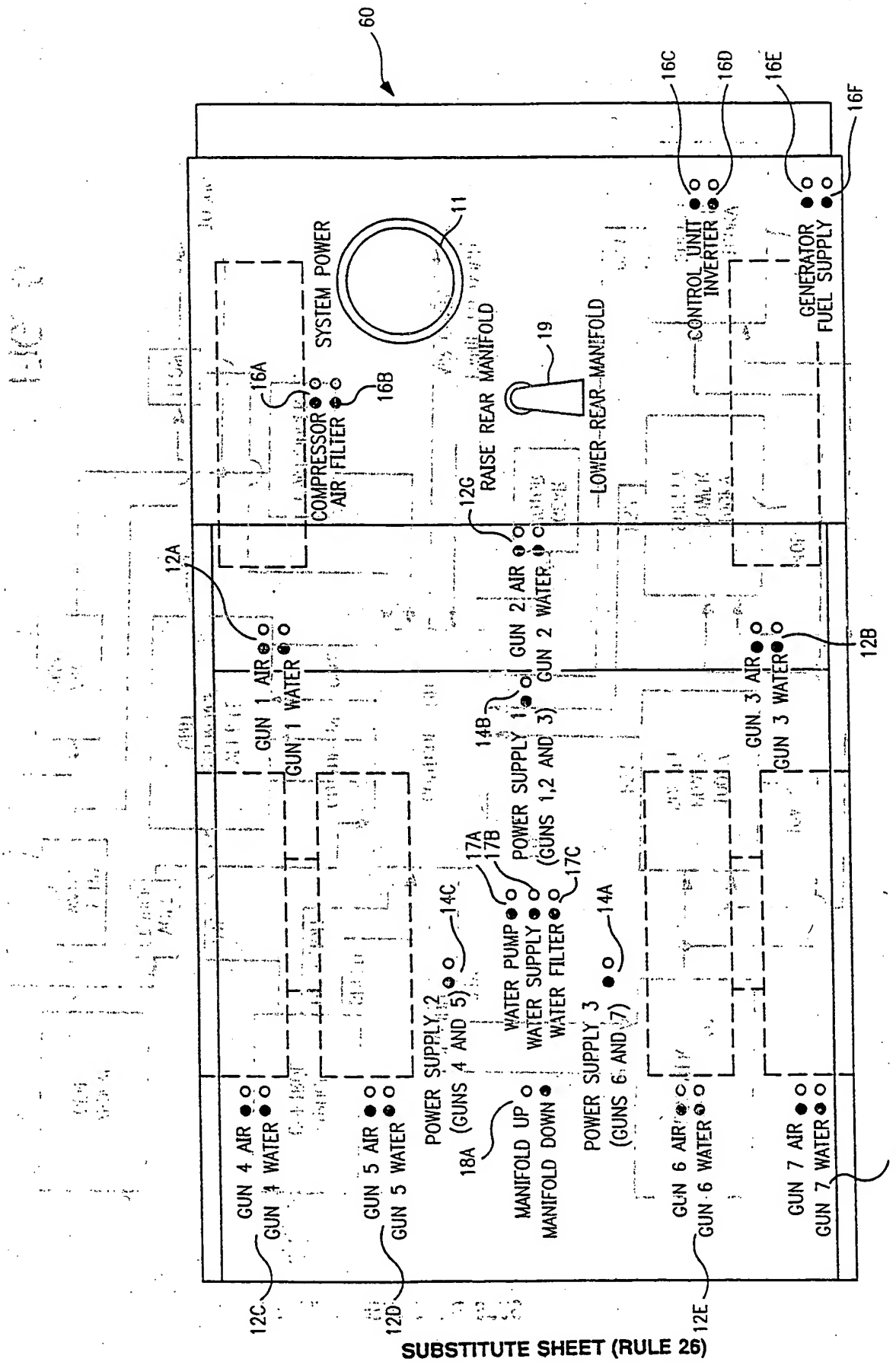

FIG. 4

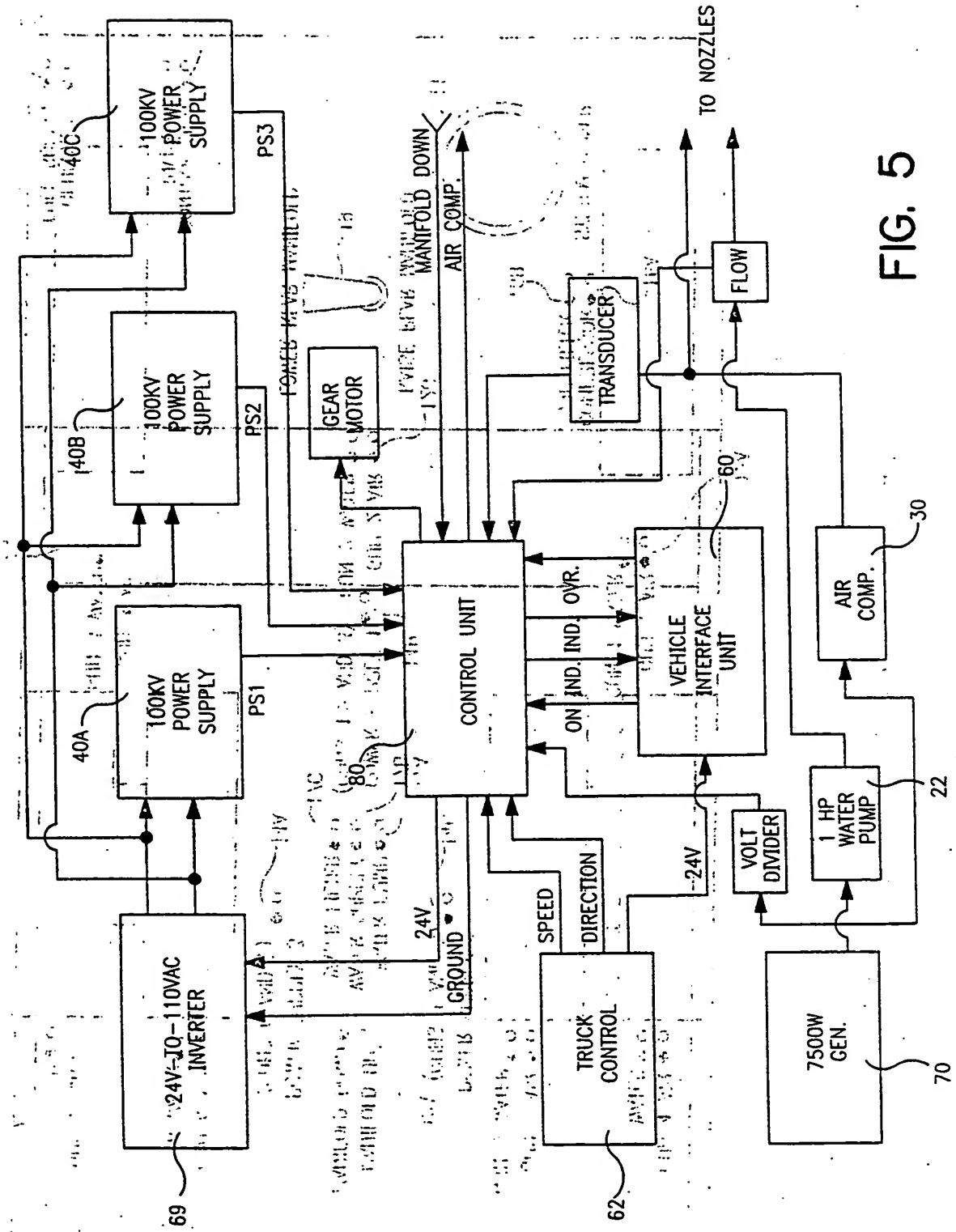

FIG. 5

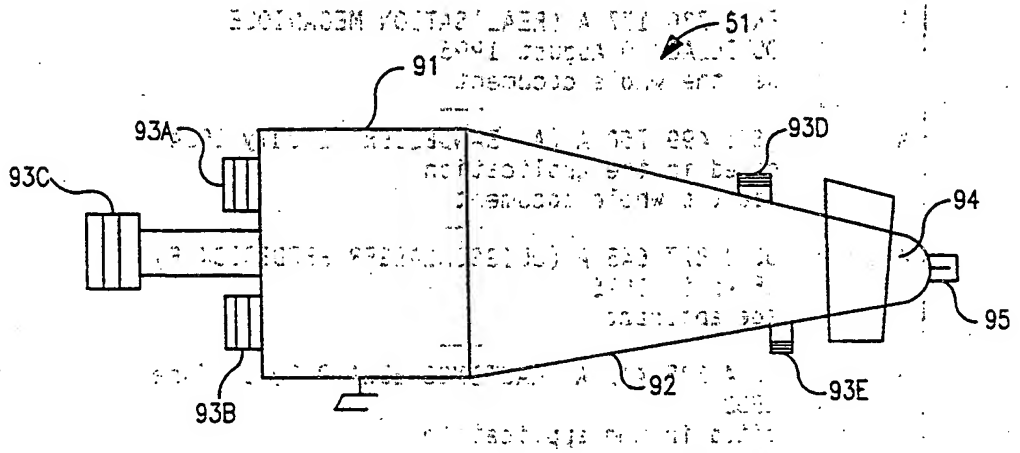

FIG. 6

INTERNATIONAL SEARCH REPORT

Ir. ational Application No
PCT/US 98/02601

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E01H3/02 E21F5/02 B05B5/00

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E21F E21C E01H B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 730 177 A (REALISATION MECANIQUE OUTILLAG) 9 August 1996, see the whole document	1-4,6,15
A	US 1 499 760 A (A. BANDELIER) 1 July 1924 cited in the application see the whole document	1,15
A	US 3 877 645 A (OLIGSCHLAEGER FREDERICK F) 15 April 1975 see abstract	1,6-15
A	US 4 335 419 A (HASTINGS EDWARD E) 15 June 1982 cited in the application see abstract	1,15

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 May 1998	27/05/1998

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 674 177 A (HAWKINS ROYAL R) 4 July 1972 see abstract	1-5

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